Optional Post- Assessment Performance

Concept(s) Addressed

Mountains form along the boundaries of plates. Two plates meet, and the plate that is denser (usually the oceanic plate) tends to sink and goes under the other plate. As the plate begins to sink, the edges tend to crumble a bit. The edges of the "land" plate also begins to crumble. As more and more of the ocean plate sinks, more crumbling from both plate edges occur. These "crumbles" begin to pile up and form mountains. This type of plate boundary is called subduction. It is also referred to as a subduction zone because this occurs over a large area at any given time. These mountains are also related to the explosive kind of volcanoes that form at these boundaries.

Time

60-100 minutes

Materials

Use Administration Manual for materials for the class and individual stations.

Individual pages for students

Advance Preparation

1. Read through the Administrative Manual (pages 3 & 4) following instructions for setting up the partner placemats and organizing materials. Label placemats for student partners with dates and plates.
2. Duplicate student pages for each student: pp 8-13
3. Review scoring rubrics pp. 15-18

Procedure:

1. Follow all directions in the administration manual.
2. Use rubrics on pages 15-18 to score selected student items.

The Fault Line Administration Procedures

Grade 5-8 Performance Task
Contributed by: California Systemic Initiative Assessment (CSIA)

Description:

In this performance task, students use cardstock models of the North American and Pacific plates and sand to investigate what happens when there is an earthquake or movement along the boundaries of the plates.

Framework References:

California Science Framework, 1990; Chapter 4, Earth Science, Section B, Geology and Natural Resources.

Big Ideas from the California Science Framework:

E-1 The Earth has changed through time.

E-3 Geological and geomorphic processes explain the evolution of the Earth.
Teacher Background:

Geological, geomorphic processes explain the evolution of the earth. Surface features are formed at plate boundaries. Erosion plays a major role in changing surface features.

Mountains form along the boundaries of plates. Two plates meet, and the plate that is denser (usually the oceanic plate) tends to sink and goes under the other plate. As the plate begins to sink, the edges tend to crumble a bit. The edges of the "land" plate also begins to crumble. As more and more of the ocean plate sinks, more crumbling from both plate edges occur. These "crumbles" begin to pile up and form mountains. This type of plate boundary is called subduction. It is also referred to as a subduction zone because this occurs over a large area at any given time. These mountains are also related to the explosive kind of volcanoes that form at these boundaries.

The San Andreas Fault is one of the longest faults in the world. It occurs along the coast of California for more than 500 miles. It is what geologists call a strike-slip fault where the movement is horizontal-one plate moves past the other. Generally speaking, the San Andreas Fault marks the boundary between the Pacific crustal plate and the North American plate. The Pacific plate is moving northward relative to the North American plate. This is occurring at the rate of nearly 5 centimeters per year. This is not very fast for us, but it is fast for geologic time.

The Pinnacles mountains were formed in the Mojave but some of them were moved north to become part of the Pinnacles of San Benito/Monterey County because they were formed at a time when the two plates were in different positions.

Materials for The Fault Line:

Materials for One Station	Materials for One Class (6 sets per class)
(1) cardstock plate model marked "Pacific Plate"	(6) cardstock plate models marked "Pacific Plate"
(1) plate model marked "North American Plate" taped to larger sheet construction paper	(6) cardstock plate models marked "N. American Plate" taped to larger sheet construction paper
(1) cup of 100 ml fine sand	(6) cups of 100 ml fine sand

Advance Preparation and Instructions for Placement of Materials on Placemat:

Tape will be needed to tape down the North American Plate. To set up this station,

1. Tape the paper model plate marked North American Plate to the work surface (large sheet of construction paper) where indicated.

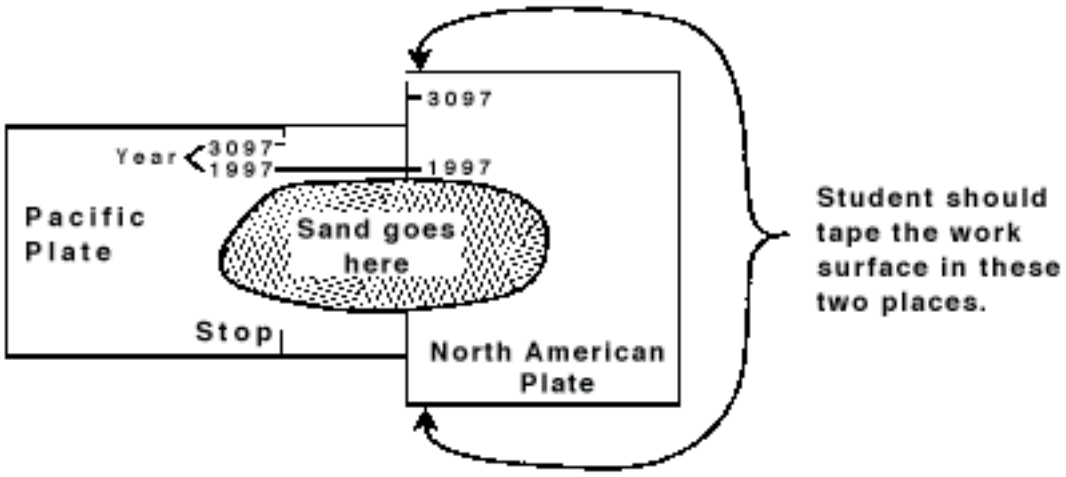
2. Tuck the edge of the paper model plate marked Pacific Plate underneath the North American Plate to the indicated line.

3. Line up the lines marked 1994.

The materials for "The Fault Line" are packed in bulk. The model plates are the placemat for the Fault Line. Arrange the model plates as shown in Figure 5.

Figure 5. Placemat for The Fault Line.

Figure 5. Placemat for The Fault Line.



Safety:

- Be careful.
- Teachers and students should always exercise appropriate safety precautions and utilize appropriate laboratory safety procedures and equipment when working on science performance tasks.

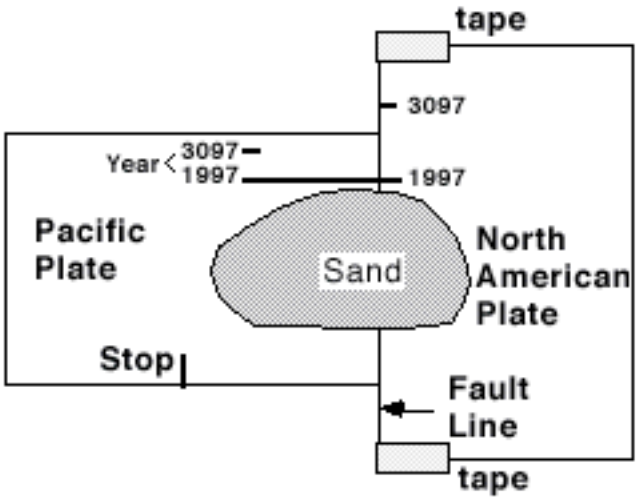
Name _____

Fault Line – Performance Task

Students in a 6th grade science class were studying plate tectonics. The teacher told the class that the Earth's surface consists of about a dozen huge plates that move into, away from, over, under and next to each other. Breaks in these plates are called faults which occur at plate boundaries.

Using models for the Pacific Plate and the North American Plate, and 100 ml of sand, the teacher had the class investigate what happens to the sand when the plates move under each other and when they move alongside of each other.

The students set up their plate models and sand as shown in the diagram below.



Use what you know about plate tectonics and the Earth's surface to make a prediction about what will happen to the sand when **you slide the Pacific Plate under the North American Plate.**

1. My prediction:

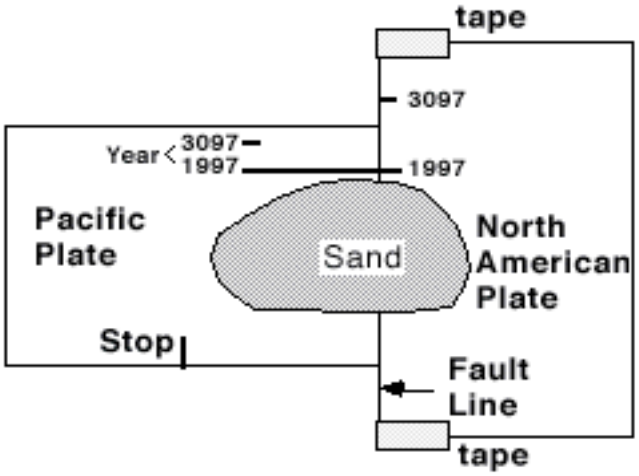
_____

Now, using what you know, make a prediction about what will happen to the sand when **you slide the Pacific Plate alongside the North American Plate.**

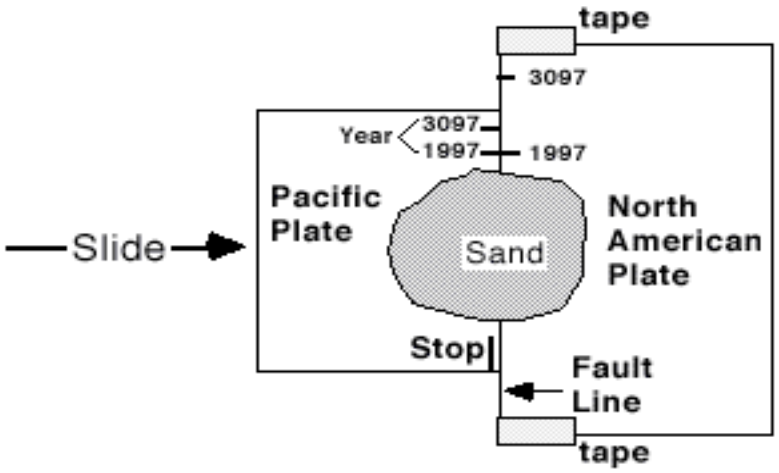
2. My prediction

Set up and Conduct Your Investigation

DIRECTIONS: With your partner, set up your plate model as shown below.



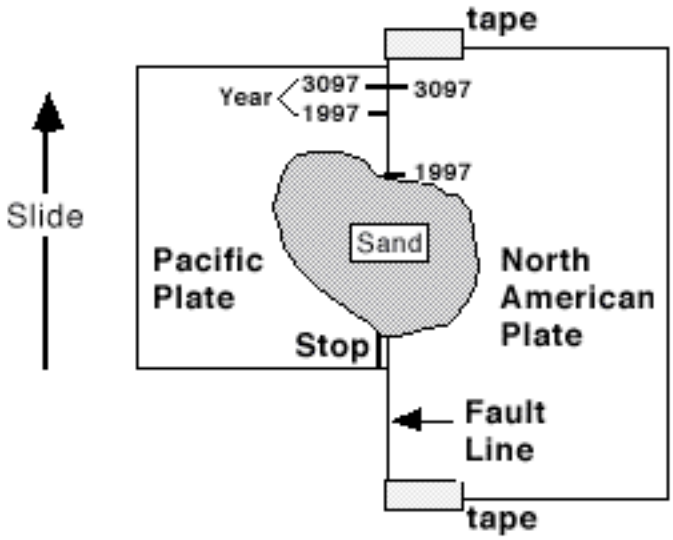
a. Check that the lines marked **1997** are lined up.
b. Place about 100 ml of sand on your plate model as shown above.
c. Smooth the sand into a thin layer.
d. With your partner, slowly slide the Pacific Plate along the **1997** line until **STOP** is even with the edge of the North American Plate as shown below**.**



Record your results and observations in the data table below in words and drawings.

Data Table: When the Pacific Plate Slides Under the N. American Plate

With your partner, carefully slide the Pacific Plate up so the 3097 lines are even.



Record your results and observations in the data table below in words and drawings.

Data Table: When the Pacific Plate Slides Upwards Alongside the N. American

Plate

<u>On your own</u>, Analyze & Use Your Observations and Results:

Look at your previous predictions.

3. Did the results of your investigation support your prediction about what will happen to the sand when you **slid the Pacific Plate under the North American Plate?**

_____

Describe what happened to the sand when you slid the Pacific Plate **under** the N. American Plate

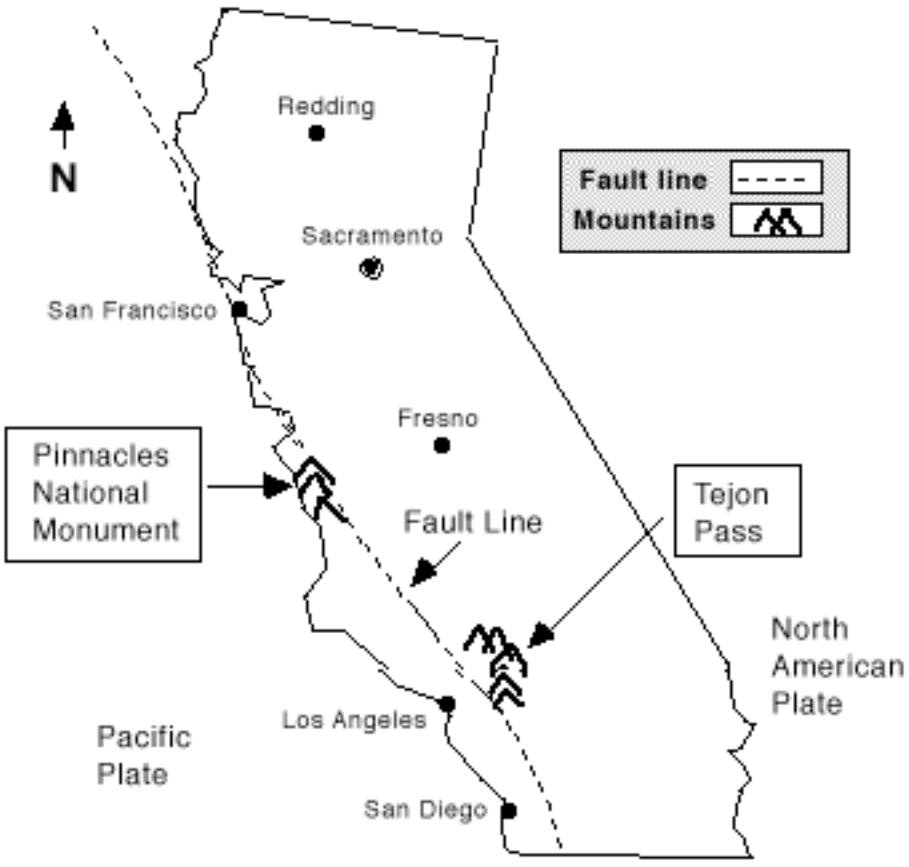
4. Using your investigation results, and your understanding of plate movements, describe how mountains are made.

Did the results of your investigation support your prediction about what will happen to the sand when you **slid the Pacific Plate upwards alongside the North American Plate? ____**

Describe what happened to the sand when you slid the Pacific Plate **upwards alongside** the N. American Plate

Applying What You've Learned

Use what you learned in your investigation and your understandings of plate movements and faults to answer the following questions.



6. Look at the map on the previous page. The mountains in the **Pinnacles National Monument** and the mountains at **Tejon Pass** were once located next to each other and were part of the same mountain range. Now they are separated by over 240 kilometers (km).

Explain how the mountains at Pinnacles National Monument and the mountains at Tejon Pass became separated from each other.

7. Los Angeles is about 600 km from San Francisco. Scientists have found that the Pacific Plate moves northward at a rate of about 100 km every million (1,000,000) years. Predict how far Los Angeles will be from San Francisco after three million (3,000,000) years. Explain your answer.

8. Earthquakes often occur along fault lines at plate boundaries. A power company is planning to build a nuclear power plant in California. (A nuclear power plant uses toxic radioactive material to create energy.) They are considering the cities of Redding, San Francisco, and San Diego as the location (see the map on the previous page). Which of these cities would be the safest choice for the nuclear power plant? Explain your answer.

Describe what happened to the sand when you slide one plate beneath the other.

Score levels	4	3	2	1
General Description	Specific, detailed, and correct	Adequate and correct	Limited	Major misconceptions
Scoring Parameter Indicators	Descriptions of the lab activity are **specific, detailed, and correct.** Uses appropriate scientific terms (sand uplift, fault line, plate movement). Connects plate motion to the upward movement of sand to create a mound or ridge. No misconceptions. Includes the mound or ridge rising along the plate boundaries /fault line. If a picture is included it must be accurately drawn and labeled.	Descriptions of the lab activity are **adequate and correct**. (Plate movement, sand uplift.) Relates plate motion to the upward movement of sand to create a mound or ridge. May contain some minor misconceptions. If a picture is included it should be accurate and have labels.	Descriptions of lab activities are **limited**. (Plate movement or sand up lift.) Includes the plate motion or the upward movement of the sand to create a mound or ridge. May include misconceptions.	Description includes major misconceptions. Uses minimal descriptive commentary
Example	"When we slid one plate beneath the other, the sand was pushed up on top of the opposing plate. When the plates moved and one plate slid beneath the other plate, the sand (land) created a mountain along the fault line."	"When we slid the plate, the sand moved up (like a mountain) because they were being squished together. The sand moved up because it couldn't move anywhere besides up because of the sand being bunched up."	"When one piece of paper slid over the other, the sand formed a mountain. This is because when 2 things of equal force hit each other at the same speed, they have no where to go but up."	"The sand moved with the plate and gradually goes under the plate."

Based on your observation of plate movements explain how mountains are made. Using the data from your investigation, explain how the mountain at Pinnacles National Monument and Teyon Pass were separated from each other.

Score Levels	**4**	**3**	**2**	**1**
General Descriptions	Specific, detailed, and correct	Adequate and correct	Limited	Major misconceptions
Scoring Parameter Indicators	Description of movements of plates as they slide past one another **are specific, detailed, and correct** (movement, mountains once together, direction). Uses appropriate scientific terms. Communicates that plate movement occurs over a period of time and along plate boundaries. No misconceptions. (Mountains were connected at one time.) Refers to data from lab. If a picture is included it must be accurately drawn and labeled.	Descriptions of movements of plates are **adequate and correct** (plate edges, movement, mountains once together). May include some minor misconceptions. If a picture is included it may include partial labels.	Descriptions of movements of plates as they slide past one another are **limited**. (May mention multiple earthquakes as a reason.) May include misconceptions (like southward motion of North American plate).	Description includes major misconceptions. Uses minimal descriptive commentary
Example	"The bottom part of California's plate probably moved. The part that was Southwest of the fault line was what moved. The plate was once more Southeast. The Pinnacles were right next to the Tejon Pass, but the plate moved Northwest until it stopped the way it is now. The plates slid past each other like the plates in our experiment."	""Over millions of years the two plates have been rubbing together at a fault moving slowly down, separating from each other."	"The earthquake on the fault line runs right between them. It probably faulted, causing them to become separate."	"Moving faults sliding past one another."

Question 8 Earthquakes and Nuclear Power Plant Location

Score Levels	4	3	2	1
General Description	Specific, detailed, and correct	Adequate and correct	Limited	Major misconceptions
	Must include Redding as location. Explanation that Redding is the farthest and safest from the plate boundary.	Would include Redding as the location, but would have little or no explanation as to why this city would be chosen.	Would select other sites and explain why the city was chosen.	Would not clearly indicate what city. A poor explanation or confusing answer.